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THE PROSPECTS FOR BUILDING CONSTRUCTION IN AMERICAN CITIES

BY

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LEONARD P. AYRES

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THE PROSPECTS FOR BUILDING CONSTRUCTION IN AMERICAN CITIES

Since the outbreak of the war in 1914 a great shortage of building construction has been accumulating in this country. When war was declared, in the summer of 1914, business was depressed and less than the normal amount of new building was being done. In 1915 business recovery was under way and the amount of building construction increased in that and the following year, but not in sufficient volume to meet current needs.

The country was entering upon a period of great war-time prosperity for commerce and industry, and available funds went into industrial production rather than into general building. Then came our own entry into the war, and in even greater measure the money and energy of the nation were diverted to the production of war supplies and munitions and necessary military construction, instead of going into the normal building of homes, stores, office buildings, factories, schools, and other peace-time structures.

As the war progressed the building deficit increased, for the Government stepped in and prevented all save the most essential building operations. After the armistice the shortage still continued to accumulate, for building wages and the costs of material mounted to such heights in 1919 and 1920 as to discourage the undertaking of new construction projects.

As a result of these restraining influences this country has not constructed in the past few years as many new buildings as it would have in ordinary times. The present publication is the report of a study carried through with the object of finding how great the existing building shortage probably is and where it is most acute.

BUILDING PERMITS

There are no official statistics compiled in this country to show the amount of building in progress or projected from month to month or by yearly totals. There are several compilations of the amounts of building permits granted by municipalities, and the F. W. Dodge Company of New York publishes monthly reports of contracts awarded in 27 states. For the present purpose data were needed showing the amounts of building undertaken in the same localities over a long series of years, for only by using such figures can trustworthy inferences be reached as to the approximate shortages of building in any given years.

Accordingly figures have been compiled by the writer giving the amounts of the building permits granted in 50 cities during the past 22 years. Most of these data were taken from the reports of the U. S. Department of the Interior. Where it was possible to secure missing data from the files of Bradstreet's that was done, and in the remaining cases the figures were secured through corresponding with the building departments of the cities concerned. These cities from which the building permit figures have been secured for each year from 1900 through 1921 are the following:

New England:	East North Central:	Southern:
Boston	Chicago	Atlanta
Cambridge	Cincinnati	Baltimore
Fall River	Cleveland	Louisville
Hartford	Columbus	Memphis
Lowell	Dayton	Nashville
New Bedford	Detroit	New Orleans
New Haven	Grand Rapids	Richmond
Providence	Indianapolis	Washington
Worcester	Milwaukee	
Middle Atlantic:	Toledo	Western:
Buffalo	West North Central:	Denver
Jersey City	Kansas City, Kansas	Los Angeles
Newark	Kansas City, Mo.	Oakland
New York	Minneapolis	Portland
Philadelphia	Omaha	San Francisco
Pittsburgh	St. Joseph	Seattle
Reading	St. Louis	
Rochester	St. Paul	
Scranton		
Syracuse		

Building permit figures are only relatively trustworthy indicators of the amount of building actually done. In some cases permits are secured and later on the project is given up. More frequently the final costs of the building are greater than was expected and so the permit figures are too low. These inaccuracies tend in some degree to counterbalance one another. A more important consideration, however, is that, while permit figures probably understate the cost of the buildings actually completed, they almost surely have in the long run an approximately steady and reliable relationship to the actual costs, and so constitute good measures by which to infer the amounts of shortage or surplus of the construction actually carried through to completion.

The upright columns of Diagram 1, on page 6, indicate the number of millions of dollars' worth of building permits granted in the 50 cities each year from 1900 through 1921. These cities had an aggregate population of 15,231,000 in 1900, which increased to 24,994,000 in 1920. They include nearly one-fourth of all the people in the country.

The figures show a rapid growth in permit value from 243 millions in 1900 to 706 millions in 1906. Then there was a decline in the value of building operations during the depression of 1907 and 1908, followed by a recovery and later on by another decline in the depressed years of 1914 and 1915. The abnormally low volume of building operations in 1917 and 1918 is clearly shown, as well as the high figures reached in 1919, 1920, and 1921.

COST OF BUILDING

The figures showing the number of millions of dollars' worth of permits granted each year do not accurately indicate the relative amounts of construction actually undertaken, for during this period the costs of building varied greatly, and the high figures of the three years following the war do not represent anything like as many houses, stores, and factories as they would have if this building had been done at the much lower costs that prevailed a few years earlier.

In order to make adjustments for these varying costs an index number of the cost of building has been worked out, and as a matter of interest it has been carried back all the way to 1840. It attempts to show about what the relative cost of building would have been in each year over this 82 year period if we take the cost in 1913 as being represented by 100.

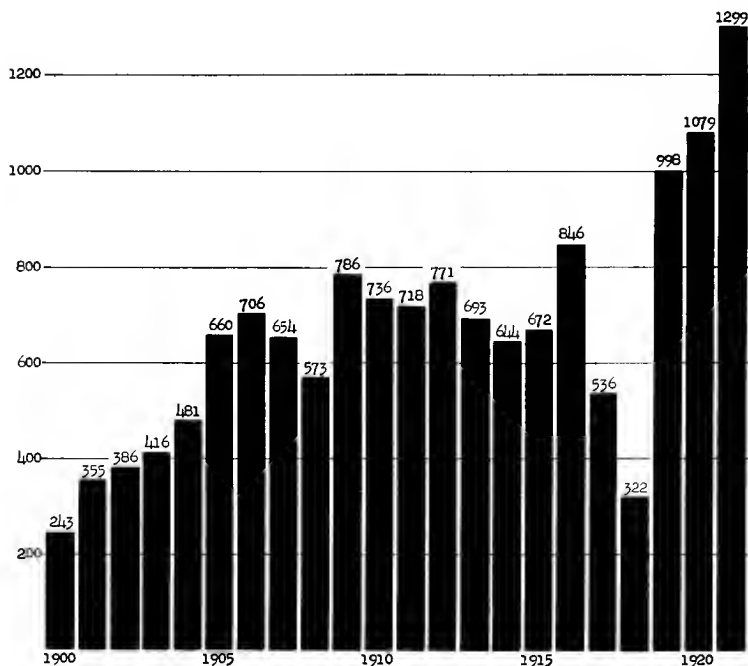


Diagram 1.—Millions of dollars' worth of building permits granted in 50 cities each year from 1900 through 1921

In constructing this index number for the cost of building it has been assumed that in the typical construction operation the expense for materials is 60 per cent of the total, and that for wages, 40 per cent. In computing labor cost the wages of the building artisans have been given twice as heavy a weighting as those for building laborers.

This index is one originally worked out by the Federal Reserve Bank of New York for the years from 1913 to 1922 and

carried back by the present writer to 1840. The data from 1840 to 1890 are taken from the Falkner report made to the U. S. Senate Committee under the chairmanship of Senator Aldrich. The later figures are from the reports of the U. S. Department of Labor.

The data for the cost of materials are those used for Building Materials by the United States Bureau of Labor Statistics, modified by the inclusion of cost figures for Metals and Metal Products since 1890, to allow for the increasing use of structural steel in building construction. These metal figures were given a weight of only 2 per cent of the whole cost for building materials in 1891 and increased by two points each year up to 1900, since which time they have been given a weight of 20 per cent each year.

The results of combining all these figures over this long span of years are shown on Diagram 2, in which the upper dashed line shows the course of material prices, the lower dotted line that of wage costs, and the solid line the cost of building in each year from 1840 through 1921. The costs for each year are expressed as relative to the costs in 1913, if those are represented as 100. Beginning in 1840 the cost of building ran along for about twenty years at a level slightly above 50. That is to say, that during these years building was only a little more than half as costly as it was in 1913.

Then in 1861 came the Civil War and a great increase in the cost of materials, which carried the cost of building up to nearly two and a half times what it was just before the war. From this high point the cost of construction fell rapidly, with one notable interruption, for some fifteen years. It then ran along without important fluctuations for twenty years more, and then began the long rise from 1898 to 1915. With the advent of the war with Germany the prices of materials, the costs for wages, and the level of building costs shot up until the peak was reached in 1920.

It is interesting to note that the increase in the cost of building during and following the World War was relatively only

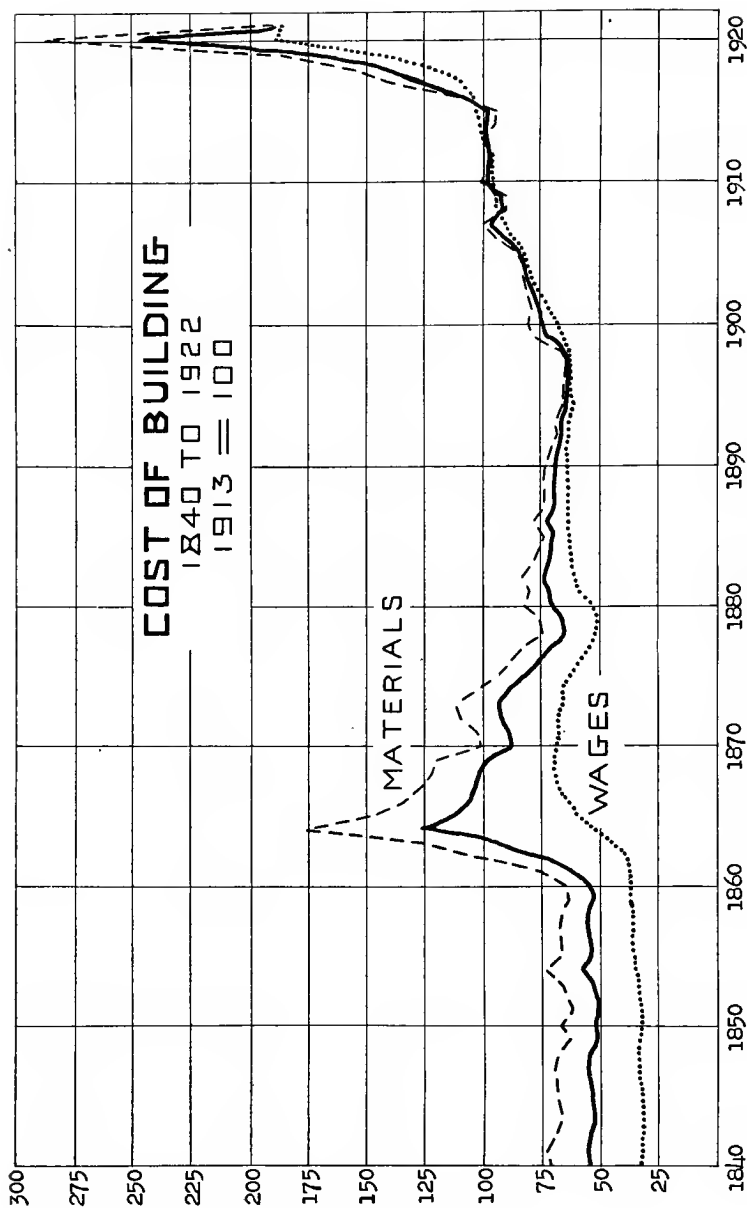


Diagram 2.—Cost of building from 1840 through 1921

slightly greater than that which occurred during the Civil War. From 1860 to 1864 the cost of building increased by 136 per cent, and in the first year after the peak of prices the decline was 12 per cent.

In the case of the World War building costs increased from 1914 to 1920 by 153 per cent, and then fell in the first year of decline 24 per cent. Thus it appears that both the increase and the immediate decline in building costs have been somewhat more violent this time than in the case of the Civil War, but not much more. It would be interesting to speculate on the probability that building costs may continue to decline irregularly over a long period of years to come, as they did after the Civil War, but this does not fall within the province of the present report.

TABLE 1.—RELATIVE COST OF BUILDING SINCE 1840 IF COSTS IN 1913 ARE TAKEN AS 100

Final figure of date	1840 to 1849	1850 to 1859	1860 to 1869	1870 to 1879	1880 to 1889	1890 to 1899	1900 to 1909	1910 to 1919	1920 to 1929
0	55.3	52.5	53.6	88.3	70.7	69.2	75.1	98.9	247.1
1	56.2	50.6	60.7	88.8	72.1	68.3	76.3	97.6	189.0
2	55.1	51.9	77.5	93.2	74.5	66.4	79.2	97.6	..
3	53.5	53.5	94.1	93.5	72.0	66.9	81.7	100.0	..
4	52.7	58.3	126.6	87.7	70.7	64.4	82.1	97.6	..
5	54.3	54.3	112.3	81.1	70.0	64.2	85.6	97.8	..
6	54.6	54.4	105.9	77.0	71.8	64.4	92.4	108.1	..
7	55.6	55.6	103.8	71.8	69.7	63.4	96.8	128.1	..
8	54.6	54.8	100.9	65.7	69.8	65.3	91.4	143.2	..
9	51.3	53.3	100.1	66.2	69.7	73.1	91.7	170.9	..

The figures showing the computed cost of building each year are given in Table 1. This table must be used differently from the ordinary one. The first number in the body of the table is 55.3 and this indicates that the relative cost of building in 1840 was 55.3. In 1841 it was 56.2, in 1842 it was 55.1, and so on down the column. The ten numbers of the column are the cost of building data for the decade beginning in 1840, and the year of the decade is indicated by the numbers from 0 to 9 in the

column at the extreme left. To find the cost of building in 1865 one would look at the number in the row opposite 5, and in the column entitled "1860 to 1869." The number opposite 5 in that column is 112.3.

These data for the cost of building are probably fairly accurate indicators of the varying cost of general construction in the country as a whole over the years indicated. They are almost surely better measures of the cost of building residences and small commercial buildings, than for large industrial and office building construction.

TABLE 2.—COST OF BUILDING BY MONTHS, USING OLD SERIES OF MATERIAL PRICES

	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922
January	100	98	96	104	115	131	149	218	211	183
February	101	99	97	105	117	133	150	237	202	183
March	101	99	97	107	119	136	150	251	195	182
April	101	99	97	108	123	137	148	261	191	..
May	101	98	98	109	125	140	153	263	189	..
June	101	98	98	108	133	143	163	261	186	..
July	100	98	98	107	138	146	169	260	184	..
August	99	98	97	107	138	148	181	258	183	..
September	99	97	97	108	136	150	191	253	180	..
October	99	97	98	109	131	150	193	250	180	..
November	99	96	99	111	130	153	197	230	182	..
December	98	96	101	115	131	152	208	225	185	..
Average	100	98	98	108	128	143	171	247	189	..

Since the construction of this index the United States Bureau of Labor Statistics has issued a new index number for the cost of building materials that is very different from the one that it has hitherto published.

It is based on more kinds of materials priced in a wider range of markets, and it gives greater weight to metals. Its weightings are based on the relative amounts of production of the different articles in 1919 instead of in 1909, as were those of the old index.

Because of the interest that exists with regard to the varying cost of building, the two indexes, based on the old figures of the Bureau of Labor Statistics and on the new figures, have been worked out by months since 1913. The figures using the old data for material costs are presented in Table 2, and those using the new data are given in Table 3. The old series has been used throughout the present study. In the opinion of the writer it gives results that are reasonably trustworthy as showing the changes in the general cost of building. Its figures for 1921 and 1922 are probably somewhat high.

TABLE 3.—COST OF BUILDING BY MONTHS, USING NEW SERIES OF MATERIAL PRICES

	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922
January	100	96	94	107	125	142	157	232	193	167
February	101	96	94	109	126	142	155	246	186	166
March	102	97	95	112	129	144	154	250	182	165
April	102	96	95	114	136	147	153	254	177	165
May	102	96	97	114	139	150	160	252	175	168
June	101	97	97	114	145	152	173	241	171	..
July	99	96	97	114	145	156	186	238	169	..
August	99	97	97	114	145	158	197	236	167	..
September	99	96	98	117	145	159	200	231	167	..
October	99	95	100	116	139	157	200	222	169	..
November	98	94	101	118	139	157	203	207	171	..
December	98	94	104	121	140	157	215	200	168	..
Average	100	96	97	114	138	152	180	234	175	..

The new data are probably more nearly trustworthy than the old ones. In so far as the results of this study are concerned, it makes little difference which series is used. Computations utilizing the old series result in an indicated shortage slightly greater than would be the case if the new figures were employed. It is interesting to note that according to these new figures the increase in the cost of building during the recent period of high prices was relatively no greater than it was during the corresponding period of the Civil War.

VOLUME OF BUILDING ON 1913 COST BASIS

By using the figures of Table 1 it is possible to revise the permit figures for the 50 cities, so as to show the relative value of the construction that would have been done in each year if the cost of building had remained constantly at the 1913 level. Thus the first column of Diagram 1 on page 6 shows that the value of the permits issued in the 50 cities in the year 1900 was 243 million dollars. But Table 1 shows that the cost of building in that year was only three-fourths as great as it was in 1913. This means that if the volume of new construction actually undertaken had been paid for at the 1913 prices, it would have cost four-thirds as much money, or 324 million dollars.

In a similar way the figures of each column of Diagram 1 can be converted to the 1913 price basis and when this is done the results are those that are shown in Diagram 3 on page 13. This diagram is simply the first diagram converted to the 1913 price basis, and since actual prices were lower in the first part of the period, and higher in the latter part, than in 1913, the columns of the diagram representing the earlier years are increased in height, and the later ones are shortened, just as that for 1900 was increased when converted to the 1913 base.

BUILDING PER CAPITA OF POPULATION

The columns of Diagram 3 show the volume of new building, as measured by its value, that was undertaken in these 50 cities over this 22 year period after the costs have all been put on the 1913 price basis. They show a rapid increase over the first six years, an irregular fluctuation around a level at about 700 millions for about twelve years, and a clearly evident shortage during the war years and those since the war.

It is to be remembered, however, that the population of these cities was increasing rapidly during this period. It was about 15,000,000 in 1900 and about 25,000,000 in 1922. A year by year comparison will be more trustworthy if the figures are converted once more to show what the amount of building was per capita of the population.

The results of this new computation are shown in the columns and figures of Diagram 4, which indicate the number of dollars' worth of new construction undertaken each year for each person in the populations of these cities. The 1913 cost basis is used throughout and the populations have been carefully estimated for each of the years between the census years.

In 1900 the value of new building undertaken was \$21 per person, as is shown by the first column of the diagram. It rose

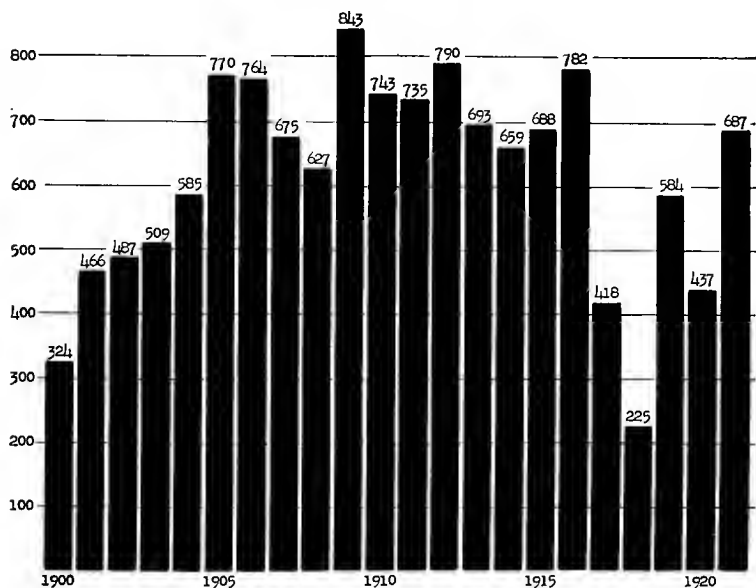


Diagram 3.—Millions of dollars' worth of building permits granted in 50 cities each year from 1900 through 1921, after figures have been converted to what they would have been if costs of building had been at the 1913 level during entire period

rapidly until it reached \$44 in 1905 and then fluctuated until 1916, when it was \$34. At this point the serious shortage began to develop. In 1917 the per capita amount fell to \$18, and in 1918 to \$9. The three years since then have shown increases, but the totals have been far below normal amounts.

Running through Diagram 4 there is a heavy slanting line.

This indicates the estimated normal amount of building over this period. It is a line drawn by the mathematical method of least squares, and it is based on the data for the years from 1900 through 1916. It may be defined as a line that represents more accurately than could any other line that might be drawn

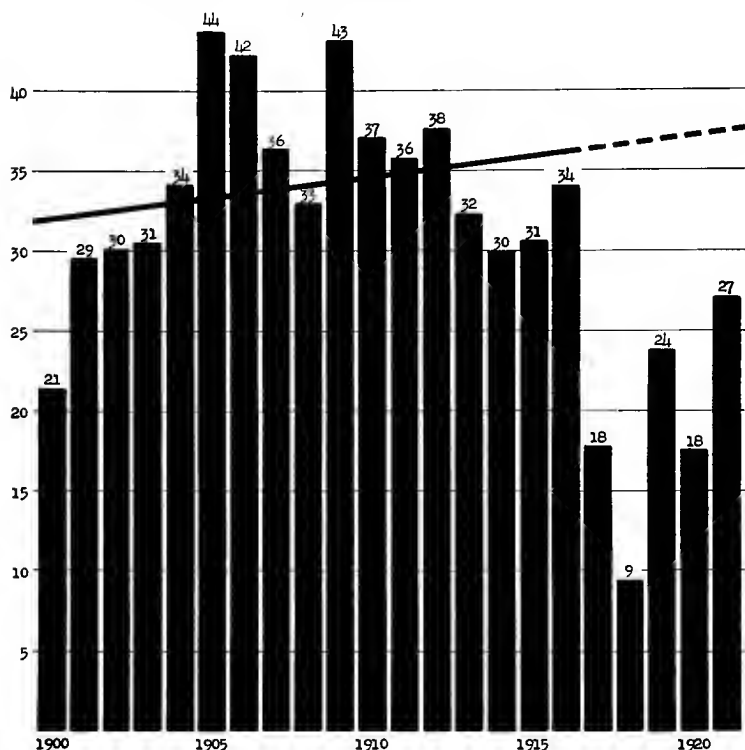


Diagram 4.—Value of building permits per capita of population for 50 cities each year from 1900 through 1921 after data have been converted to 1913 cost basis. Straight line shows general trend from 1900 through 1916

the general trend of the irregular series of amounts indicated by the columns for the years from 1900 through 1916. At its right hand end this line has been extended in a dashed line and the difference between the columns from 1916 on, and the height of this line above the base, is taken to show the amount

of the existing building shortage at the beginning of 1922. The detailed figures on which the diagrams for the 50 cities are based are given in Table 4.

TABLE 4.—VALUE OF BUILDING PERMITS IN MILLIONS OF DOLLARS IN 50 CITIES EACH YEAR FROM 1900 THROUGH 1921, THEIR VALUE CONVERTED TO THE BASIS OF THE COST OF BUILDING IN 1913, AND THEIR VALUE PER CAPITA OF POPULATION EACH YEAR ON THE 1913 COST BASIS

Year	Value of building permits (millions)	Value of building permits on 1913 basis (millions)	Per capita value of permits on 1913 cost basis
1900	243.3	324.0	\$21.27
1901	355.4	465.8	29.64
1902	385.7	487.0	30.07
1903	415.5	508.6	30.48
1904	480.5	585.2	34.09
1905	659.5	770.4	43.64
1906	705.6	763.7	42.10
1907	653.7	675.3	36.26
1908	572.6	626.5	32.78
1909	786.2	842.6	42.99
1910	735.8	743.2	37.00
1911	718.0	734.9	35.72
1912	770.5	789.5	37.48
1913	693.4	693.4	32.17
1914	643.7	658.8	29.88
1915	671.9	687.7	30.52
1916	845.7	782.3	33.97
1917	535.7	418.2	17.78
1918	321.9	224.9	9.37
1919	998.4	584.2	23.84
1920	1079.3	436.8	17.48
1921	1298.9	687.2	26.96

SHORTAGES IN THE INDIVIDUAL CITIES

On the six pages which follow are 50 small diagrams showing the per capita amounts of building undertaken in each city each year on the 1913 cost basis. Through the irregular heavy line of each little diagram there has been drawn a straight line representing the general trend of the volume of building during the pre-war years. In nearly every case there is an indicated shortage in the past six years, and the area of this shortage has been shaded to show its relative amount.

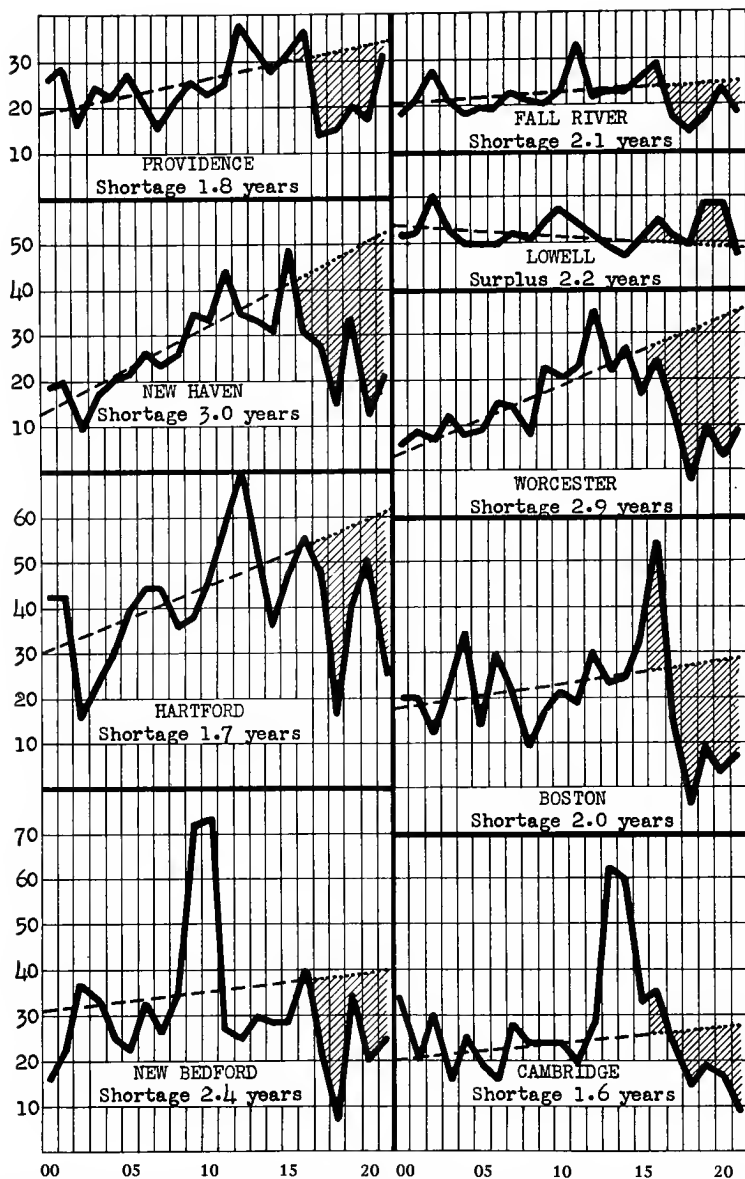


Diagram 5.—Nine New England Cities. Per capita value of permits shown by heavy black lines, general trend based on pre-war records and shown by straight dashed and dotted lines, and computed shortage of building shown by shaded areas

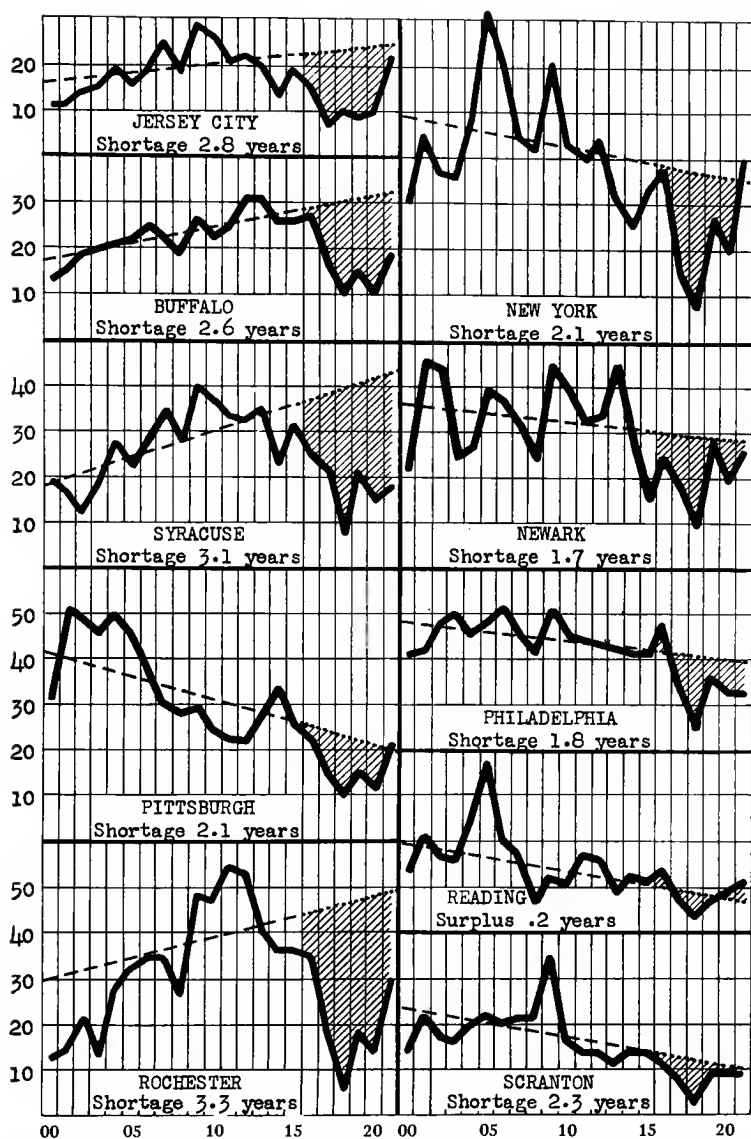


Diagram 6.—Ten Middle Atlantic Cities. Per capita value of permits shown by heavy black lines, general trend based on pre-war records and shown by straight dashed and dotted lines, and computed shortage of building shown by shaded areas

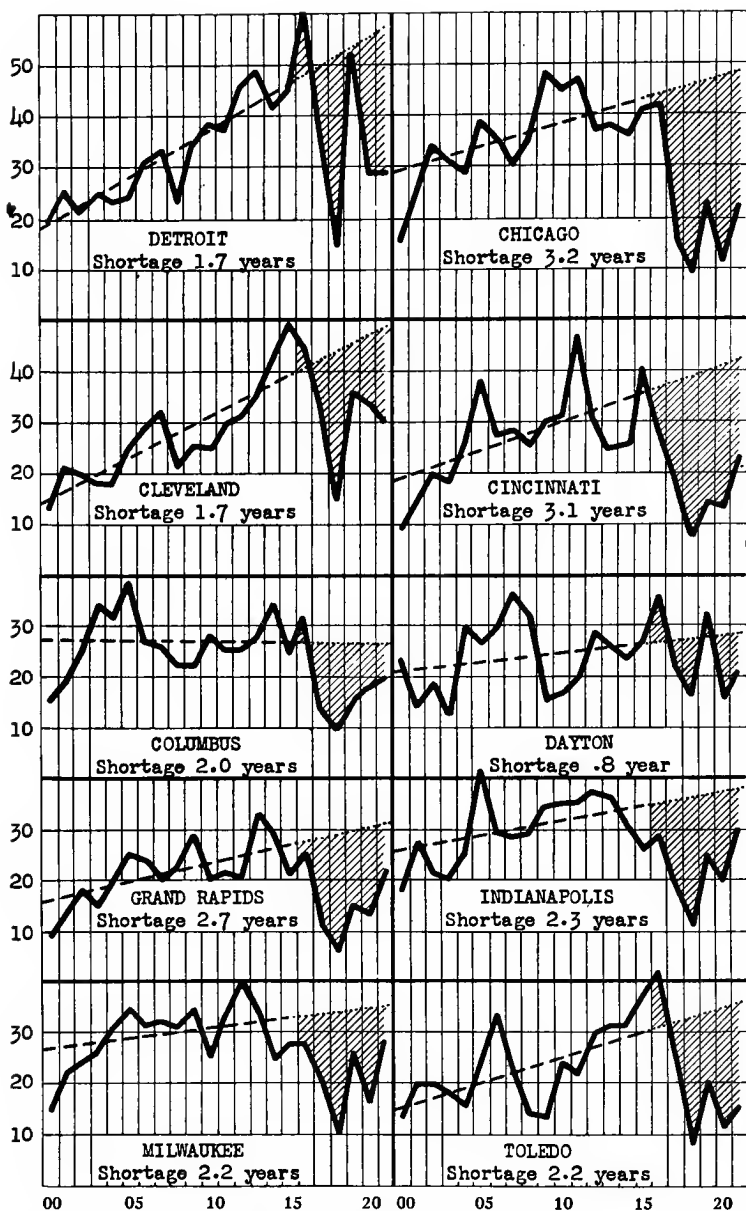


Diagram 7.—Ten East North Central Cities. Per capita value of permits shown by heavy black lines, general trend based on pre-war records and shown by straight dashed and dotted lines, and computed shortage of building shown by shaded areas

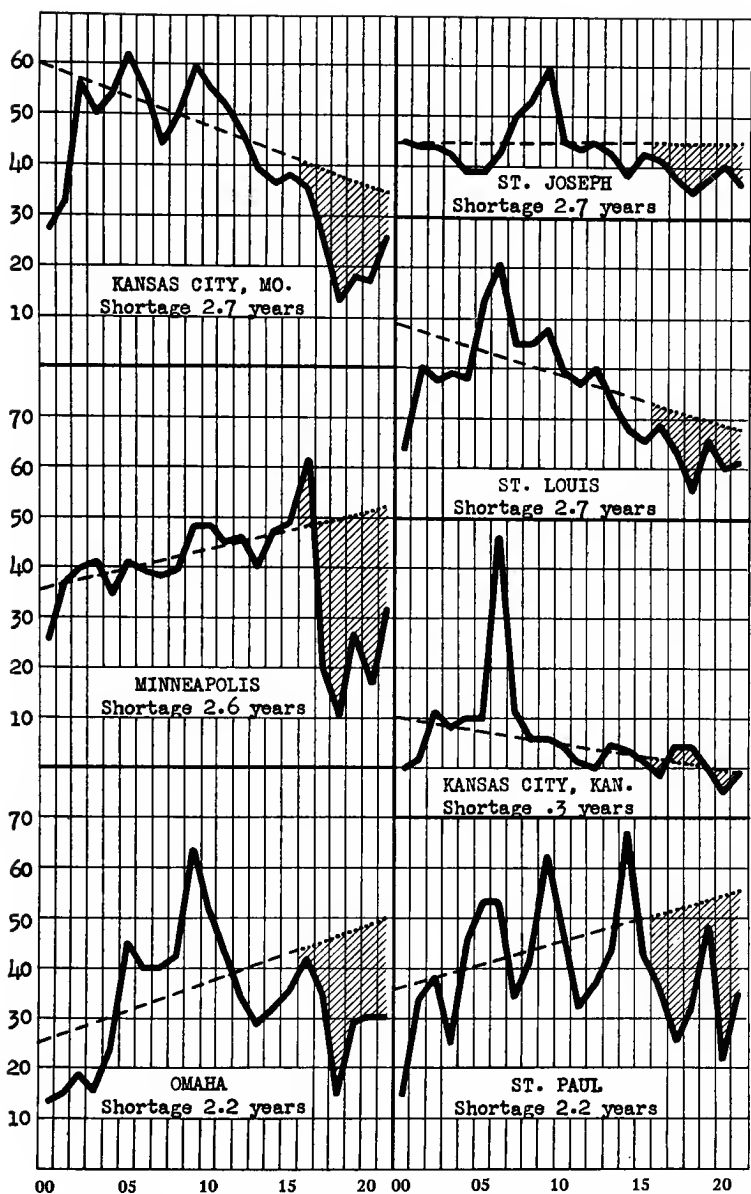


Diagram 8.—Seven West North Central Cities. Per capita value of permits shown by heavy black lines, general trend based on pre-war records and shown by straight dashed and dotted lines, and computed shortage of building shown by shaded areas

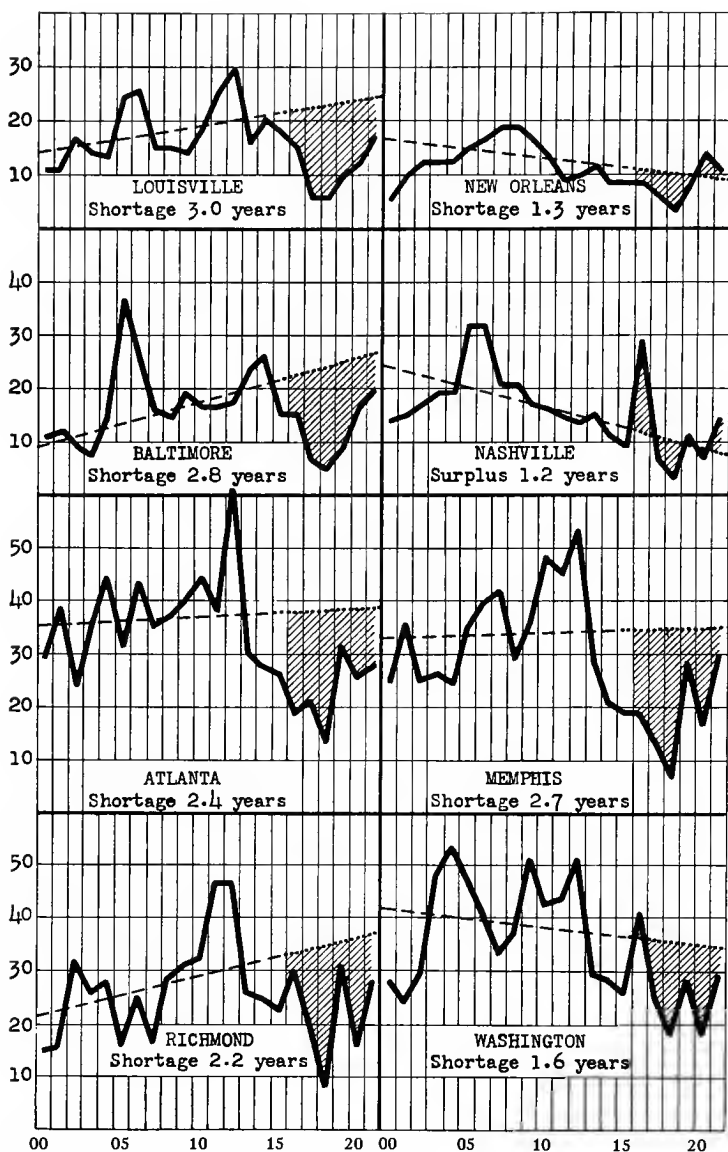


Diagram 9.—Eight Southern Cities. Per capita value of permits shown by heavy black lines, general trend based on pre-war records and shown by straight dashed and dotted lines, and computed shortage of building shown by shaded areas

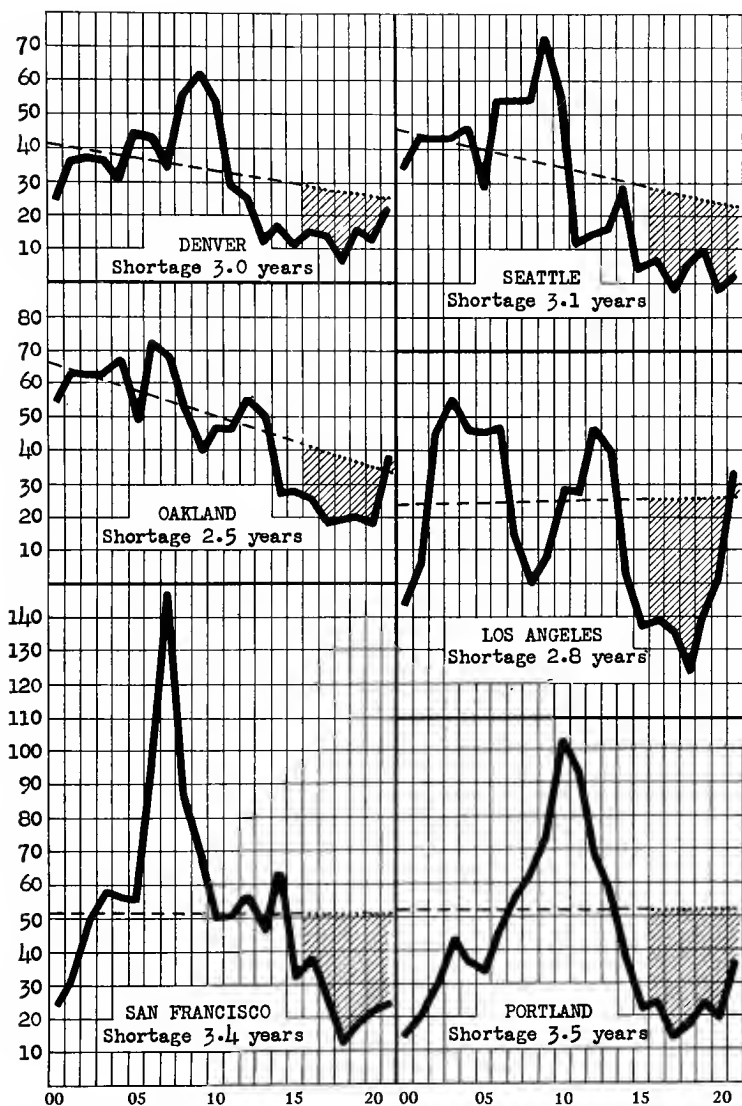


Diagram 10.—Six Western Cities. Per capita value of permits shown by heavy black lines, general trend based on pre-war records and shown by straight dashed and dotted lines, and computed shortage of building shown by shaded areas

In every case a computation has been made to find what the normal volume of building for 1921 would have been, and the indicated shortage has been estimated in terms of this 1921 normal. For example, in the case of Providence, there is found to be a shortage amounting to 1.8 years of building construction, calling the normal amount for one year that which was estimated as normal for 1921. This is shown in the first of the small diagrams on page 16.

These estimates for individual cities have been made by the same methods that have been described in connection with the computations for the entire group of 50 cities. The amount of permits granted each year from 1900 through 1921 has first been ascertained. These have then been converted to show what they would have been if the cost of building had remained during the entire period on the 1913 basis. The next step was to compute the population for each of the twenty-two years, basing this work on the census figures for 1900, 1910, and 1920, and taking care to allow for any annexations during that period.

After the population figures were found, the permit figures, converted to the 1913 cost basis for each year, were divided by the population figures to find the amount of construction per capita. After this was determined the location of the trend line was computed by the method of least squares, and in nearly every case this was based on the records of the fifteen years from 1901 through 1915.

In several cases the records of cities showed one or two exceptional building years which could not be used at their face value for helping to determine pre-war trends. Such cases occurred for instance in San Francisco and Baltimore in the years following their great fires, when building activity was abnormally great. In these cases there have been substituted for the abnormally large figures of these exceptional years, numbers equal to the average of the other years of the pre-war period used. This has been done in the cases of the two cities mentioned, and also for certain years in the records of Cambridge, Mass., Reading, Pa., and Kansas City, Kansas.

There were several other departures from the standard procedure. In the cases of Newark, New York, and Pittsburgh in the North Atlantic Division, and in those of Denver, Los Angeles, Oakland, and Seattle in the Western Division, the trend line was based on the records of the sixteen years from 1900 to 1915 inclusive. In the case of Rochester, the years from 1904

TABLE 5.—INDICATED SHORTAGE OF BUILDING CONSTRUCTION IN 50 CITIES AT BEGINNING OF 1922. THE SHORTAGES ARE RECORDED BY YEARS, TAKING AS ONE YEAR THE VOLUME OF CONSTRUCTION ESTIMATED AS NORMAL FOR EACH CITY FOR 1921

City	Rank in descending order	Years of shortage	City	Rank in descending order	Years of shortage
Atlanta	23	2.4	*Nashville	49	1.2
Baltimore	12	2.8	Newark	42	1.7
Boston	35	2.0	New Bedford	24	2.4
Buffalo	20	2.6	New Haven	10	3.0
Cambridge	43	1.6	New Orleans	45	1.3
Chicago	4	3.2	New York	33	2.1
Cincinnati	5	3.1	Oakland	22	2.5
Cleveland	39	1.7	Omaha	28	2.2
Columbus	36	2.0	Philadelphia	37	1.8
Dayton	46	.8	Pittsburgh	34	2.1
Denver	8	3.0	Portland	1	3.5
Detroit	40	1.7	Providence	38	1.8
Fall River	32	2.1	*Reading	48	.2
Grand Rapids	15	2.7	Richmond	29	2.2
Hartford	41	1.7	Rochester	3	3.3
Indianapolis	25	2.3	St. Joseph	18	2.7
Jersey City	13	2.8	St. Louis	19	2.7
Kansas City, Kan.	47	.3	St. Paul	30	2.2
Kansas City, Mo.	16	2.7	San Francisco	2	3.4
Los Angeles	14	2.8	Scranton	26	2.3
Louisville	9	3.0	Seattle	6	3.1
*Lowell	50	2.2	Syracuse	7	3.1
Memphis	17	2.7	Toledo	31	2.2
Milwaukee	27	2.2	Washington	44	1.6
Minneapolis	21	2.6	Worcester	11	2.9

through 1916 were used. In the case of Portland, Oregon, it was not possible to be sure that the pre-war records indicated any real trend, so the average for the sixteen years from 1900 through 1915 was used instead. All these variations from the

* Surplus.

general practice were adopted because special conditions in the records of the cities seemed to indicate that they would produce more trustworthy results than would be secured by basing the computations on the data for the fifteen years from 1901 through 1915, which was the general practice.

Table 5 shows the amount of the computed shortage of each of the cities and its rank if we consider the city having the greatest shortage as being in first place. At one extreme is Portland, Oregon, with an indicated shortage so great that it would be equal to the normal construction during 3.5 years. At the other extreme are Nashville, Reading, and Lowell, which show no shortage at all, but instead surpluses, ranging from 0.2 year to 2.2 years.

SHORTAGES BY GEOGRAPHICAL GROUPS

The records for the different individual cities have been brought together by groups in Diagram 11 on page 25. Here the per capita expenditures for each year are represented by the upright columns, while the trend lines are shown as in the other diagrams. The indicated shortages are represented by the shaded areas filling in the space between the columns showing the actual construction of the last six years, and the trend lines showing the computed normal volume of building for that same period. These shortages range from 1.9 years in the Middle Atlantic states to 3.0 years in the Western group.

In three of the groups of cities the general trend line slants upward, while in the three remaining groups it slants down. In Diagram 4, which showed the per capita construction for the entire group of 50 cities, it slanted up, and a study of the individual diagrams will show that in 18 cases the trend is down, and in practically all the remaining 32 it is up.

It is not difficult to explain the general tendency for the per capita expenditures for new building to rise, even after the figures of permit values have been converted to a constant cost basis, which is in this case that of 1913. This tendency to increase apparently reflects the rising standard of housing in

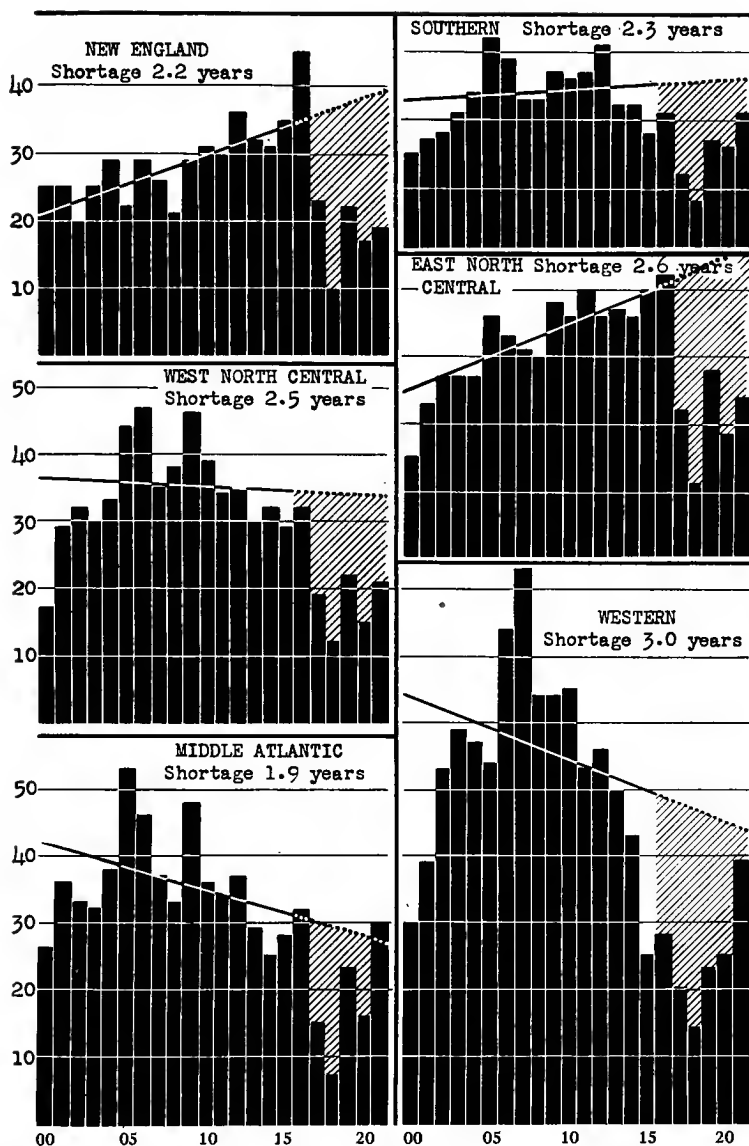


Diagram 11.—Six groups of cities. Per capita value of permits shown by columns, general trend based on pre-war records and shown by straight solid and dotted lines, and computed shortage of building shown by shaded areas

this country which manifests itself in business, industrial, and public building, as well as in residence construction. During the past twenty-five years a new type of dwelling house has come into existence in this country. It has hardwood floors, steam heating, modern plumbing, electric lighting, and a completely finished basement. In ever-increasing measure these features are being incorporated even in the houses occupied by people of the most modest incomes, while every growing city is becoming surrounded by suburbs largely consisting of houses far surpassing in beauty, convenience and elegance all except the very finest houses of a few decades ago.

Similar changes in accepted standards are taking place in our office buildings, factories, schools, theatres, and public buildings. The general standards are rising, and as the public taste is educated to demand more, the average level of expenditure per person goes up.

It is harder to explain why it should not show this rising tendency in practically all the cities, instead of in only about two-thirds of them. The most important element of the explanation is undoubtedly to be found in the varying rates of growth of the different cities.

If a city should have a stationary population over a long period of years, it would require new building construction only for the purpose of replacing old buildings when they became unsuitable for further use, or the occasional erection of some new structure required by some such modern development as the automobile. Clearly such a city would have a low per capita construction record. On the other hand, cities that grew with such unparalleled rapidity as did those of the far west from 1900 to 1910 required for a time a much greater per capita expenditure than they could over a long term of years.

RANGE OF AVERAGE VALUES

There is a great range in the annual average value of the new construction undertaken for each person in the population of these cities. Over the pre-war period, which is in most cases

the fifteen years from 1901 through 1915, the city of Lowell, Mass., has an average yearly per capita expenditure of \$12.07, while at the other extreme is Los Angeles, with an average of \$64.31. The average of these figures for the entire 50 cities is \$30.84.

TABLE 6.—YEARLY AVERAGE PER CAPITA VALUE OF BUILDING PERMITS ON 1913 COST BASIS IN 50 CITIES FOR THE PRE-WAR PERIOD FROM 1901 THROUGH 1915

City	Average	City	Average
1. Lowell	\$12.07	26. Milwaukee	\$30.27
2. Fall River	12.60	27. Indianapolis	30.33
3. New Orleans	12.87	28. St. Louis	30.53
4. St. Joseph	14.47	29. Boston	31.73
5. Reading	14.86	30. Pittsburgh	32.82
6. Kansas City, Kan.	15.50	31. Newark	33.19
7. Baltimore	16.00	32. Detroit	33.20
8. Nashville	18.07	33. Memphis	33.80
9. Scranton	18.27	34. Denver	34.43
10. Louisville	18.47	35. New Bedford	34.54
11. Jersey City	19.27	36. Omaha	34.93
12. Grand Rapids	21.87	37. Chicago	36.73
13. Buffalo	23.07	38. Atlanta	36.87
14. Cambridge	23.31	39. Rochester	38.54
15. Toledo	23.67	40. Washington	38.87
16. Dayton	24.00	41. Hartford	41.80
17. Philadelphia	25.07	42. Minneapolis	42.13
18. Providence	25.27	43. New York	43.44
19. Worcester	26.33	44. St. Paul	43.53
20. Columbus	27.20	45. Kansas City, Mo.	50.20
21. Richmond	27.73	46. San Francisco	51.42
22. Syracuse	27.93	47. Portland	52.00
23. Cleveland	28.13	48. Oakland	52.62
24. New Haven	28.13	49. Seattle	57.31
25. Cincinnati	28.47	50. Los Angeles	64.31

These figures are given in Table 6 on this page. It will be noted that the cities having the lowest averages are largely mill cities, or southern cities. Those having the highest figures are mostly cities which are located in the far West, and have had exceptionally rapid growths. The average for New York City, where the amount of construction is so enormous that its value in many years is more than one-half as great as that for the other 49 cities combined, is relatively high. It amounts to \$43.44, and in only seven cities is the average higher than this.

SHORTAGES AND SURPLUSES

The per capita value of permits on the 1913 cost basis was shown for the 50 cities in Diagram 4 on page 14. Through the upper part of that diagram there was drawn a slanting line showing what the normal construction in each year would have been if the general trend of the pre-war years had been continued over the entire period. In that diagram this trend line

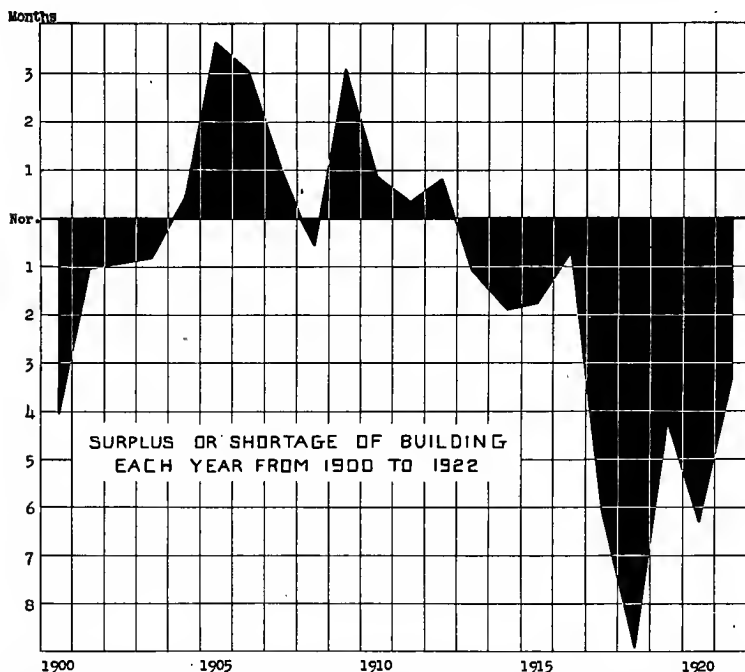


Diagram 12.—Months of surplus over normal, or shortage under normal, of building in 50 cities during each year from 1900 through 1921

was based on the actual data for the seventeen years beginning in 1900 and running through 1916.

For the first four years the actual amounts were under the computed normal, as indicated by the trend line. During the next nine years the actual amounts were above the computed normal, except in 1908, which was a year of severe business

depression. All the other years show deficiencies but not serious ones until we entered the war in 1917. From that point on building construction was clearly far below normal.

Since we have these actual records which are in each case below or above the theoretical normal amounts for the same years, it becomes a simple matter to construct another diagram in which the computed normal is represented as a level line, and the shortages and surpluses are shown below or above that line for each year. This has been done in Diagram 12, on page 28. The values of the diagram are in terms of months. In 1900 the actual construction was only two-thirds of the estimated normal, so there was a shortage equal to the construction that would normally have been undertaken in one-third of a year, or four months. In each of the three following years there was a shortage equivalent to the normal construction of about one month. After that there were surpluses for four years. By these same methods the shortages and surpluses are shown over the entire period. In 1918, when the Government restrictions were in force, the actual construction was only about one-fourth of the computed normal, so there was a shortage of nearly nine months in the amount of building undertaken.

If there is a shortage of building each year for several years in succession, a serious shortage accumulates, and it may take several years of more than normal building to wipe it out. This is what appears actually to have happened during the period under consideration, and the course of these accumulations of shortage and surplus is shown in the final diagram, which is numbered 13, on page 30.

Diagram 13 is constructed on the theory that there was neither surplus nor shortage of building at the beginning of 1900. We do not know that this was the case, but we do know that the two preceding years had been years of business recovery following a depression, and years of considerable building activity. The assumption that building conditions were reasonably in balance at the beginning of 1900 is probably not far wrong.

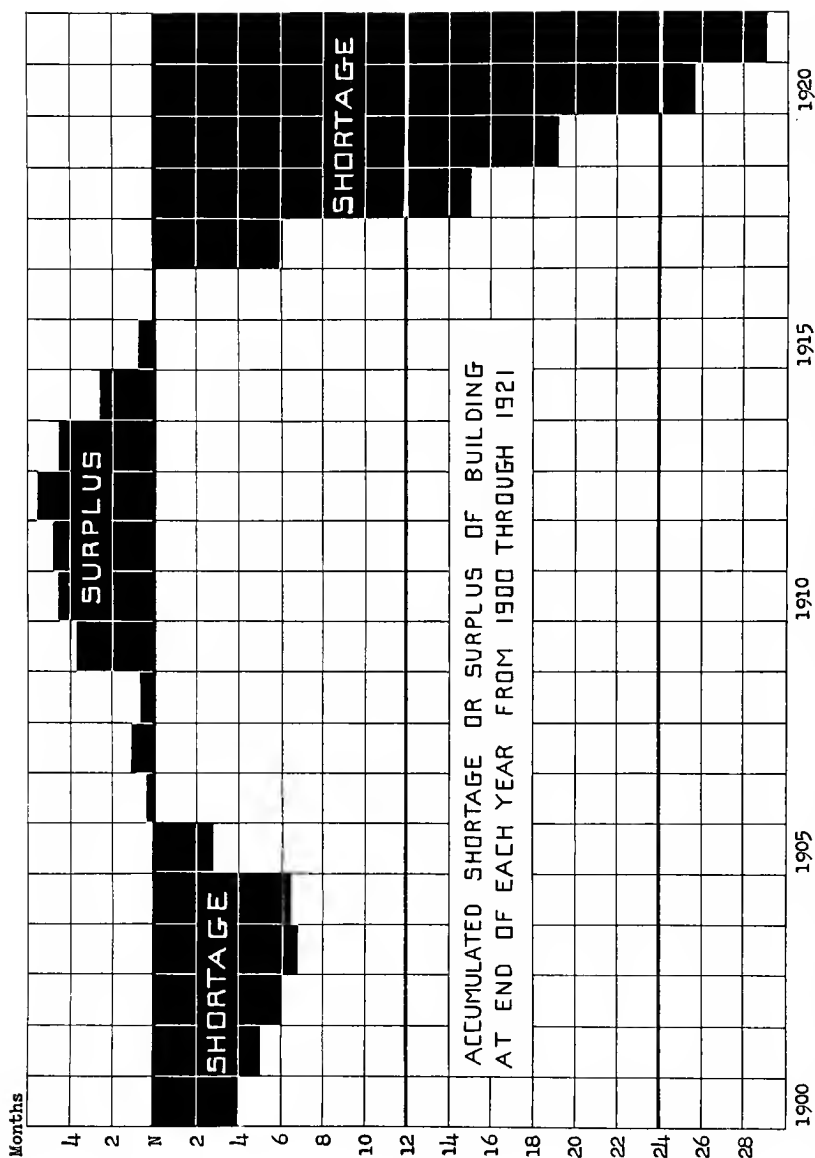


Diagram 13.—Months of surplus over normal, or shortage under normal, of building in 50 cities. Diagram shows the amount accumulated to the end of each year from 1900 through 1921

During 1900 there was a shortage of four months, and this is shown on the diagram by the black column below the normal line. During the following three years this was increased by about one month each year until it amounted to nearly seven months in 1903. It was then rapidly cut down by the active building of the following years until a surplus existed in 1906. This increased to a surplus of over five months in 1912, when it began to shrink, and this continued to 1916, when a condition of balance was reached, with neither surplus nor shortage.

Then came the great shortages of the war and the post-war period, and the accumulating deficit grew until it was more than a year by the end of 1918, more than two years by the end of 1920, and 2.44 years by the end of 1921. If this estimate is substantially correct, it means that there exists in American cities an indicated shortage of building construction so great that the building industry could operate at nearly 25 per cent above normal for a period of ten years before it would entirely make it up.

It is certain that the building industry will not operate steadily during the coming decade at a rate that is 25 per cent above its normal, for that is not the way in which new construction comes into existence. It will have its periods of great activity, as it is now having one in 1922, and it will have dull periods at times when building costs are too high, and at times when business is depressed. It is highly probable, however, that the industry will feel the stimulus of the accumulated shortage for several years to come, and perhaps for as much as ten years.

NATURE OF SHORTAGE

If we accept it as reasonably well demonstrated that there existed in these 50 cities at the end of 1921 a shortage of building construction approximately equal to the amount that would have been normally completed in about two and a half years, we can estimate from the records of actual construction about how many and what sorts of buildings would have to be erected to wipe out the deficit.

From the building records of these cities for 1920 and 1921 figures have been compiled showing the different kinds of buildings constructed in these years. By using these figures, and assuming that to make up the existing shortage would require more building of substantially the same sort, a rough estimate of the amount of construction still needed becomes possible.

From this estimate it appears that the shortage existing at the beginning of 1922 was such that it would require about 1,256,000 building operations to make it up. Of these operations, about 703,000 would call for the erection of new buildings, while the remaining 553,000 would be for annexes, additions, alterations, etc. Of the 703,000 new buildings, about 303,000 would be residential, and the remaining 400,000 buildings of other sorts. A large majority of these latter buildings would be garages. The 303,000 residential buildings would mainly be one-family houses, but a sufficient number of them would shelter more than one family to furnish accommodations in all for about 424,000 families.

The further one carries such estimates the less reliable they become, but they are of value because they rest on carefully treated evidence, and are far more trustworthy than mere guesses. In a rough general way one might estimate the probable shortage of building in the entire country by multiplying by four the figures that have just been cited. The justification for doing this would be found in the fact that these 50 cities include in their populations nearly one-fourth of all the people in the country. Such a series of estimates for the whole country would probably give results somewhat too high, for these cities are growing more rapidly than the country as a whole, and require more new building. They probably restricted construction more than the smaller communities did during the war years, and so incurred relatively greater deficits.

There are two comments that may well be added concerning the material that has been discussed in this report. The first is that not all of any shortage such as those now existing in

building construction in our cities, has to be made up. Part of these shortages has already been made up through using old buildings longer than they would have been used if there had been no war. Such use is like the extra use that we may have given a pair of shoes or a suit of clothes during the war period. After we had made these garments last a year longer than was normal, we had taken from them a certain amount of service that was a permanent gain and that did not have to be made up. On the other hand, the fact that we had worn them for more than the regular length of time brought us into the market after the war with an insistent demand that could not well be longer postponed. It seems probable that if due allowance were made for the extended use of buildings that would under ordinary circumstances have been replaced some years ago, the estimates of this report would not be greatly changed.

The second comment relates to the reliability of the method of estimating shortages by extending a trend line based on previous records and taking it to represent about what would probably have happened under ordinary circumstances, which means in this case what building would have been done if there had been no war. This method gives valuable and reliable results about in proportion as the material being studied is of such a sort that wide fluctuations do not characteristically take place, and the records extend back over a relatively long period. In the present case the mass estimates for the 50 cities are considerably more reliable than are those for the six geographic groups, and these in turn are much more trustworthy than those for the individual cities. The separate computations for the 50 individual cities are of the nature of prophecies and have all the uncertainty that must affect such forecasts even when they are, as in this case, based on carefully compiled data, that have been interpreted with care and caution.

SUMMARY

1. Since the outbreak of the war in 1914 a great shortage of building construction has been accumulating in this country.

2. A study has been made of the value of building permits in 50 large cities from 1900 through 1921, and by extending the general trend of the pre-war expenditures an attempt has been made to estimate what the volume of new construction would probably have been if the war had not occurred.

3. The difference between the new construction actually undertaken in the six years from 1916 through 1921, and the amount that probably would have been begun if the war had not intervened, is so great that it is equal to 2.44 times the estimated normal construction for 1921.

4. The existing building shortage in these 50 cities is so great that building could continue at about 25 per cent above its normal activity for ten years before it would entirely make up the deficit.

5. To make up the indicated deficit in these 50 cities would apparently require about 1,256,000 building operations, of which 703,000 would call for the erection of new structures, and the remaining 553,000 for additions, alterations, etc.

6. Of the 703,000 new buildings, about 303,000 would be residential, and the remaining 400,000 would be buildings of other sorts, of which a large majority would be garages. The 303,000 residential buildings would be largely one-family houses, but a sufficient number of them would shelter more than one family to furnish accommodations in all for about 424,000 families.

7. Since these 50 cities include in their populations nearly one-fourth of all the people in the country, the figures that have been given may be multiplied by four to give a rough, although probably high, estimate of the building shortage in the entire country.

8. Figures showing the annual course of the cost of building since 1840 indicate that the relative increase and succeeding drop in building costs at the time of the Civil War were similar

to the corresponding price movements during and after the World War, but the latter were somewhat more violent.

9. There is a great range in the average annual per capita expenditure for new buildings in these 50 cities. The lowest figure is \$12.07 for Fall River, the highest, \$64.31, is Los Angeles, and the average, \$30.84 for all the cities.

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